Classifying Soils, Substrate, and the Benthic Environment

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riaes
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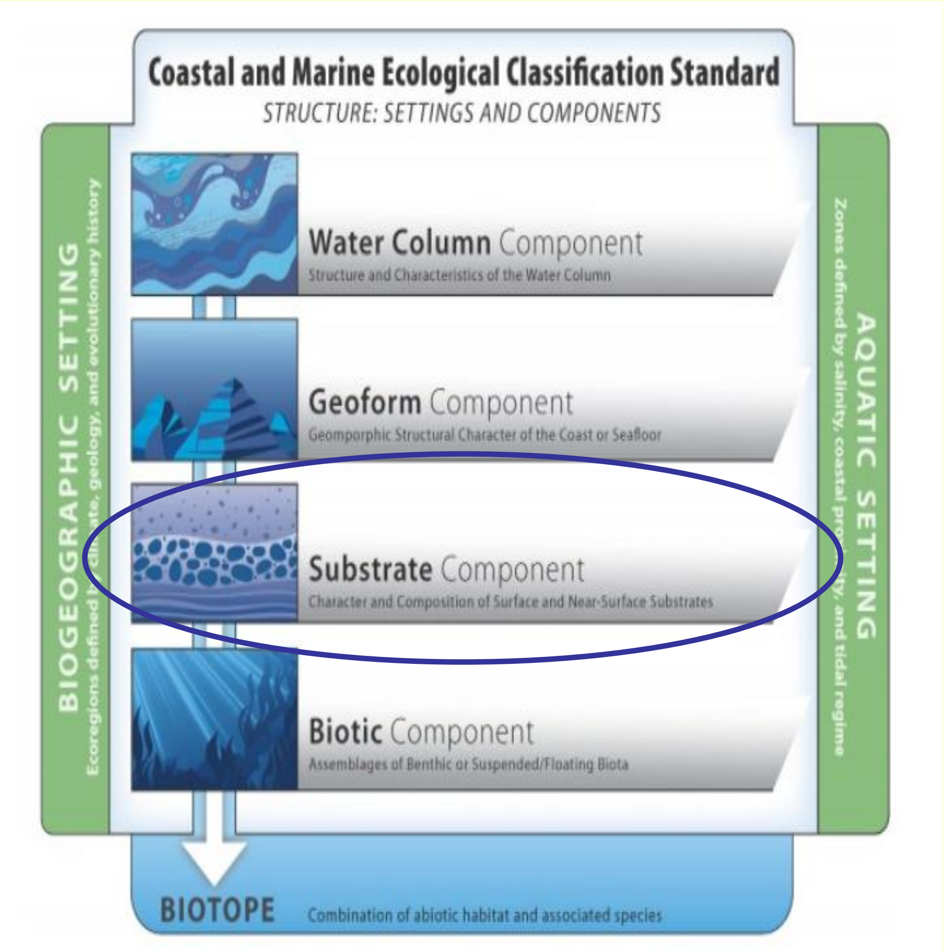
Coastal and Marine Ecological Classification Standard (CMECS)

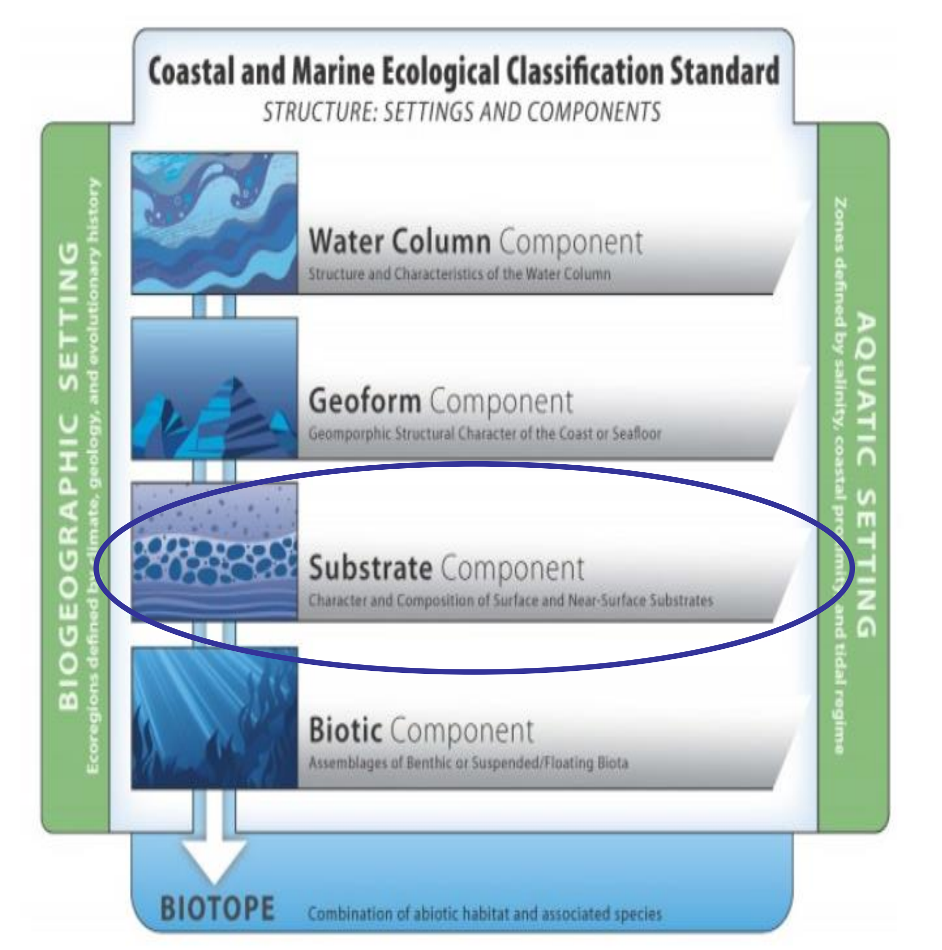
- Provides a comprehensive national framework for organizing information about coasts and oceans and their living systems.
- Includes the physical, biological, and chemical data that are collectively used to define coastal and marine ecosystems.



Coastal and Marine Ecological Classification Standard (CMECS)

CMECS uses Folk (1954) as it standard classification system for the substrate component:

“CMECS adopted Folk (1954) due to the clear present-day preferences for it among public and invited reviewers of CMECS, its long-standing historical use in marine work, and its straight-forward approach to classification”;



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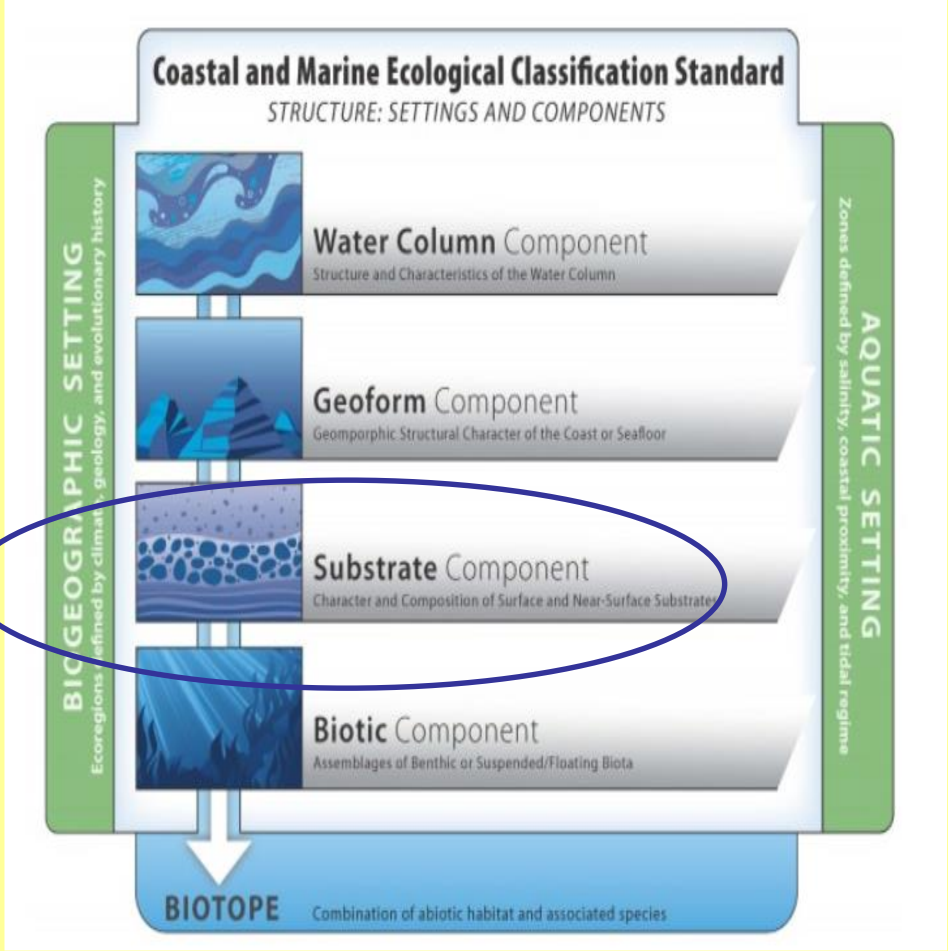
<u>However in the next paragraph……</u>



“the Soil Geographic Data Standard, FGDC-STD-006 (FGDC, 1997) and Keys to Soil Taxonomy (Soil Survey Staff, 2010) together provide more detailed classification options for classifying soils with many hundreds of descriptors that have been used in soil science for decades. Users should consider these sources and approaches when classifying substrate in these areas. <u>It is recommended that a soils approach be used if a more detailed classification is needed for interpreting use and management of shallow water substrates.”</u>

What are the implications of this?

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Since CMECS is a Federal Geographic Data Committee (FGDC) approved standard, and the authors recommended FGDC-STD-006 for classifying shallow water substrates if use and management is a goal, any project having US federal funding is expected to follow these recommendations.

Subaqueous Soil Suborders

- **Wassents:** subaqueous Entisols. Defined as Entisols that have a positive water potential at the soil surface for more than 21 hours of each day. These soils are the first suborder to classify out under Entisols. The formative element Wass is derived from the German (Swiss) word "wasser" for water.
- **Wassists:** subaqueous Histosols. Defined as Histosols that have a positive water potential at the soil surface for more than 21 hours of each day. These soils are the second suborder to classify out under Histosols after Folists.

Wassent Great Groups

- **Frasiwassents:** Wassents that have, in all horizons within 100 cm of the mineral soil surface, an electrical conductivity of **<0.6 dS/m** in a 5/1 by volume mixture of water and soil.
- **Psammowassents:** Wassents that have less than 35 percent (by volume) rock fragments and a texture of loamy fine sand or coarser in all layers within the particle-size control section.
- **Sulfiwassents:** Wassents that have sulfidic materials within 50 cm of the mineral soil surface.
- **Hydrowassents:** Wassents that have, in all horizons at a depth between 20 and 50 cm below the mineral soil surface, both **fluid** and 8 percent or more clay in the fine earth fraction.
- **Fluviwassents:** Wassents that have *either* 0.2 percent or more organic carbon of Holocene age at a depth of 125 cm below the mineral soil surface *or* an irregular decrease in content of organic carbon from a depth of 25 cm to a depth of 125 cm or to a densic, lithic, or paralithic contact if shallower.
- **Haplowassents:** Other Wassents**.**

Wassent Subgroups

- There are between four and six subgroups for each great group.
- Examples include:
  - **Lithic Sulfiwassents**: have a lithic contact within 100 cm of the mineral soil surface.
  - **Haplic Sulfiwassents:** have, in some horizons at a depth between 20 and 50 cm below the mineral soil surface, *either or both*: 1. An *n* value of 0.7 or less; *or* 2. Less than 8 percent clay in the fine-earth fraction.
  - **Thapto-Histic Sulfiwassents:** have a buried layer of organic soil materials, 20 cm or more thick, that has its upper boundary within 100 cm of the mineral soil surface.
  - **Fluvic Sulfiwassents:** have *either* 0.2 percent or more organic carbon of Holocene age at a depth of 125 cm below the mineral soil surface *or* an irregular decrease in content of organic carbon from a depth of 25 cm to a depth of 125 cm or to a densic, lithic, or paralithic contact if shallower.
  - **Aeric Sulfiwassents:** have a chroma of 3 or more in 40% or more of the matrix of one or more horizons between a depth of 15 and 100 cm from the soil surface.
  - **Typic Sulfiwassents:** Other Sulfiwassents.

Fundamental Changes to Soil Taxonomy Task Force

Soil Science Society of America

Mark Stolt, Univ. of Rhode Island (chair)	**Curtis Monger**, NRCS
Brian Needelman, Univ. of Maryland (co-chair)	**Anthony O'Geen**, Univ. of California-Davis
Dylan Beaudette, NRCS	**Marty Rabenhorst**, Univ. of Maryland
Patrick Drohan, Penn State	**Mickey Ransom**, Kansas State
John Galbraith, Virginia Tech	**Joey Shaw**, Auburn
David Lindbo, NRCS	

Fundamental Changes to Soil Taxonomy Task Force

Soil Science Society of America

Task force objective: to facilitate an open and transparent process to develop a suite of fundamental changes to Soil Taxonomy leading to a more user-friendly product that can and will be used by more than just trained soil scientists

Fundamental Changes to Soil Taxonomy Task Force

Soil Science Society of America

Remove unnecessary complexity

Reformat to emphasize soil properties and related interpretations

Provide a consistent framework of definitions and terminology across taxa

2. Is an Ap horizon that, when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:

a. 16 percent or more if the mineral fraction contains 60 percent or more clay; *or*

b. 8 percent or more if the mineral fraction contains no clay; *or*

c. 8 + (clay percentage divided by 7.5) percent or more if the mineral fraction contains less than 60 percent clay.

Most histic epipedons consist of organic soil material (defined in chapter 2). Item 2 provides for a histic epipedon that is an Ap horizon consisting of mineral soil material. A histic epipedon consisting of mineral soil material can also be part of a mollic or umbric epipedon.

Melanic Epipedon

Required Characteristics

The melanic epipedon has *both* of the following:

1. An upper boundary at, or within 30 cm of, either the mineral soil surface or the upper boundary of an organic layer with andic soil properties (defined below), whichever is shallower; *and*

2. In layers with a cumulative thickness of 30 cm or more within a total thickness of 40 cm, *all* of the following:

a. Andic soil properties throughout; *and*

b. A color value, moist, and chroma of 2 or less throughout and a melanic index of 1.70 or less throughout; *and*

c. 6 percent or more organic carbon as a weighted average and 4 percent or more organic carbon in all layers.

Mollic Epipedon

Required Characteristics

The mollic epipedon consists of mineral soil materials and, after mixing of the upper 18 cm of the mineral soil or of the whole mineral soil if its depth to a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan (all defined below) is less than 18 cm, has the following properties:

1. When dry, *either or both*:

a. Structural units with a diameter of 30 cm or less or secondary structure with a diameter of 30 cm or less; *or*

b. A moderately hard or softer rupture-resistance class; *and*

2. Rock structure, including fine stratifications (5 mm or less thick), in less than one-half of the volume of all parts; *and*

3. *One* of the following:

a. *Both* of the following:

(1) Dominant colors with a value of 3 or less, moist, and of 5 or less, dry; *and*

(2) Dominant colors with chroma of 3 or less, moist; *or*

b. A fine-earth fraction that has a calcium carbonate equivalent of 15 to 40 percent and colors with a value and chroma of 3 or less, moist; *or*

c. A fine-earth fraction that has a calcium carbonate equivalent of 40 percent or more and a color value, moist, of 5 or less; *and*

4. A base saturation (by NH_4OAc) of 50 percent or more throughout; *and*

5. An organic-carbon content of:

a. 2.5 percent or more if the epipedon has a color value, moist, of 4 or 5; *or*

b. 0.6 percent (absolute) more than that of the C horizon (if one occurs) if the mollic epipedon has a color value less than 1 unit lower or chroma less than 2 units lower (both moist and dry) than the C horizon; *or*

c. 0.6 percent or more and the epipedon does not meet the qualifications in 5-a or 5-b above; *and*

6. The minimum thickness of the epipedon is as follows:

a. 25 cm if:

(1) The texture class of the epipedon is loamy fine sand or coarser throughout; *or*

(2) There are no underlying diagnostic horizons (defined below) and the organic-carbon content of the underlying materials decreases irregularly with increasing depth; *or*

(3) *Any* of the following, if present, are 75 cm or more below the mineral soil surface:

(a) The upper boundary of the shallowest of any identifiable secondary carbonates or a calcic horizon, petrocalcic horizon, duripan, or fragipan (defined below); *and/or*

(b) The lower boundary of the deepest of an argillic, cambic, natric, oxic, or spodic horizon; *or*

b. 10 cm if the epipedon has a texture class finer than loamy fine sand (when mixed) and it is directly above a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan; *or*

c. 18 to 25 cm and the thickness is one-third or more of the total thickness between the mineral soil surface and:

(1) The upper boundary of the shallowest of any identifiable secondary carbonates or a calcic horizon, petrocalcic horizon, duripan, or fragipan; *and/or*

(2) The lower boundary of the deepest of an argillic, cambic, natric, oxic, or spodic horizon; *or*

d. 18 cm if none of the above conditions apply; *and*

7. Phosphate:

a. Content less than 1,500 milligrams per kilogram by citric-acid extraction; *or*

b. Content decreasing irregularly with increasing depth below the epipedon; *or*

c. Nodules are within the epipedon; *and*

8. Some part of the epipedon is moist for 90 days or more (cumulative) in normal years during times when the soil temperature at a depth of 50 cm is 5 °C or higher, if the soil is not irrigated; *and*

9. The *n* value (defined below) is less than 0.7.

Ochric Epipedon

The ochric epipedon fails to meet the definitions for any of the other seven epipedons because it is too thin or too dry, has too high a color value or chroma, contains too little organic carbon, has too high an *n* value or melanic index, or is both massive and hard or harder when dry. Many ochric epipedons have either a color value of 4 or more, moist, and 6 or more, dry, or chroma of 4 or more, or they include an A or Ap horizon that has both low color values and low chroma but is too thin to be recognized as a mollic or umbric epipedon (and has less than 15 percent calcium carbonate equivalent in the fine-earth fraction). Ochric epipedons also include horizons of organic materials that are too thin to meet the requirements for a histic or folistic epipedon.

The ochric epipedon includes eluvial horizons that are at or near the soil surface, and it extends to the first underlying diagnostic illuvial horizon (defined below as an argillic, kandic, natric, or spodic horizon). If the underlying horizon is a B horizon of alteration (defined below as a cambic or oxic horizon) and there is no surface horizon that is appreciably darkened by humus, the lower limit of the ochric epipedon is the lower boundary of the plow layer or an equivalent depth (18 cm) in a soil that has not been plowed. Actually, the same horizon in an unplowed soil may be both part of the epipedon and part of the cambic horizon; the ochric epipedon and the subsurface diagnostic horizons are not all mutually exclusive. The ochric epipedon does not have rock structure and does not include finely stratified fresh sediments, nor can it be an Ap horizon directly overlying such deposits.

Plaggen Epipedon

The plaggen epipedon is a human-made surface layer 50 cm or more thick that has been produced by long-continued manuring.

A plaggen epipedon can be identified by several means. Commonly, it contains artifacts, such as bits of brick and pottery, throughout its depth. There may be chunks of diverse materials, such as black sand and light gray sand, as large as the size held by a spade. The plaggen epipedon normally shows spade marks throughout its depth and also remnants of thin stratified beds of sand that were probably produced on the soil surface by beating rains and were later buried by spading. A map unit delineation of soils with plaggen epipedons would tend to have straight-sided rectangular bodies that are higher than the adjacent soils by as much as or more than the thickness of the plaggen epipedon.

Required Characteristics

The plaggen epipedon consists of mineral soil materials and has the following:

1. Locally raised land surfaces; *and* one or both of the following:

a. Artifacts; *or*

b. Spade marks below a depth of 30 cm; *and*

2. Colors with a value of 4 or less, moist, 5 or less, dry, and chroma of 2 or less; *and*

3. An organic-carbon content of 0.6 percent or more; *and*

4. A thickness of 50 cm or more; *and*

5. Some part of the epipedon that is moist for 90 days or more (cumulative) in normal years during times when the soil temperature at a depth of 50 cm is 5 °C or higher, if the soil is not irrigated.

Umbric Epipedon

Required Characteristics

The umbric epipedon consists of mineral soil materials and, after mixing of the upper 18 cm of the mineral soil or of the whole mineral soil if its depth to a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan (all defined below) is less than 18 cm, has the following properties:

1. When dry, *either or both*:

a. Structural units with a diameter of 30 cm or less or secondary structure with a diameter of 30 cm or less; *or*

b. A moderately hard or softer rupture-resistance class; *and*

2. Rock structure, including fine stratifications (5 mm or less thick), in less than one-half of the volume of all parts; *and*

3. *Both* of the following:

a. Dominant colors with a value of 3 or less, moist, and of 5 or less, dry; *and*

b. Dominant colors with chroma of 3 or less, moist; *and*

2. Is an Ap horizon that, when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:

a. 16 percent or more if the mineral fraction contains 60 percent or more clay; *or*

b. 8 percent or more if the mineral fraction contains no clay; *or*

c. 8 + (clay percentage divided by 7.5) percent or more if the mineral fraction contains less than 60 percent clay.

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4. A base saturation (by NH_4OAc) of 50 percent or more throughout; *and*

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3. An organic-carbon content of 0.6 percent or more; *and*

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1. When dry, *either or both*:

a. Structural units with a diameter of 30 cm or less or secondary structure with a diameter of 30 cm or less; *or*

b. A moderately hard or softer rupture-resistance class; *and*

2. Rock structure, including fine stratifications (5 mm or less thick), in less than one-half of the volume of all parts; *and*

3. *Both* of the following:

a. Dominant colors with a value of 3 or less, moist, and of 5 or less, dry; *and*

b. Dominant colors with chroma of 3 or less, moist; *and*

Mollic epipedon: Color, crushed, & smoothed has a value 3 or less moist & chroma 3 or less moist (3/3 or darker). Dry color must have a value of 5 or less. Thickness is at least 18 cm and one-third of the depth from the soil surface to the lower boundary of the diagnostic subsurface horizon if that depth is <75 cm. Otherwise, at least 25 cm thick. Base saturation >50% throughout.

Removing inconsistencies in terminology and definitions of organic soil materials

Proposal 1: Use a single value of SOC (wt %) to define OSM regardless of if the soils are saturated or unsaturated.

Proposal 2: Define fibric, hemic, and sapric materials based on rubbed fiber content only.

Proposal 3: Use only the terms sapric, hemic, and fibric to describe organic soil materials.

What changes are needed for coastal soils?

Application of hypo and hyper sulfidic

Introduce new epipedons

Establish a wet soil order (Aquasols)

Create a new subgroup for salt marsh soils with > 2 meters of OSM

Remove the 2.5 m water depth limit from the definition of soil and just use "shallow water" like is done in CMECS.